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Psoriasis Response to the Pulsed Dye Laser

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Background and Objective: **In psoriasis the blood vessels are enlarged and dilated. These vessels, the psoriatic microvasculature, have been implicated as participating in the pathogenesis of psoriasis. The purpose of this preliminary study was to use the flashlamp-pumped pulsed dye laser, which selectively damages dermal vessels, to treat psoriatic plaques and to evaluate the role of the vasculature in the therapeutic response.**
Materials and Methods: **Ten patients with psoriasis were treated with the pulsed dye laser on single, stable psoriasis plaques. Treatments varied between one and three times, and the lesional response was graded using a scale for erythema, scaling, and infiltration.**
Results: **Six of 10 patients experienced a beneficial clinical effect after therapy. The psoriasis severity scale in these patients was reduced to 2.2 ± 1.3 compared with a 7.2 ± 1.7 grade for control areas. The plaques readily developed crusting with therapy, with one leg lesion healing with atrophy. Histopathology in three patients immediately after therapy showed no epidermal damage. One week after laser therapy, the necrotic former epidermis was apparent in superficial crusting. Epidermal thinning and regeneration was seen without any signs of psoriasis.**
Conclusions: **Pulsed dye laser therapy may improve plaque psoriasis. This improvement may be related to the role the microvasculature plays in psoriasis.** © 1996 Wiley-Liss, Inc.

Key words: flashlamp-pumped pulsed dye laser, psoriatic microvasculature

INTRODUCTION

In psoriasis the capillaries of the dermal papillae are enlarged, dilated, and tortuous. It has been suggested that abnormal capillaries may induce the earliest suprapapillary changes by recruiting inflammatory cells into the epidermis [1]. The flashlamp-pumped pulsed dye laser has been used effectively to treat different superficial vascular lesions, such as port-wine stains and telangiectasia [2]. In one attempt it was also used for the treatment of psoriasis with limited success [3]. In this report, psoriatic patients treated with the flashlamp-pumped dye laser are evaluated for therapeutic response and microscopic outcome. This laser, which causes selective vascular damage in the dermis, may help further support the importance of the microvasculature in psoriasis.

PATIENTS AND METHODS

Ten patients were included in the study. Three were women. The patients were enrolled into the study from a general dermatology clinic after volunteering and giving informed consent.

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The mean age was 44 years (range 30–70 years), with all patients having plaque-type psoriasis. The mean duration of the lesion over the involved area treated was approximately 2 years (range 6 months to 3.5 years). These lesions had been treated with emollients, topical steroids, and, in some cases, tar, ultraviolet-B, or PUVA therapy, with continued persistence. Seven patients had lesions over the legs, two had them over the arms, and one had them over the trunk.

A flashlamp-pumped pulsed dye laser was used at a pulse duration of 360–450 μsec and at a wavelength emission of 585 nm. The spot size was 5 mm. The laser output was measured with an energy meter.

The energy applied varied between 6.5 and 8 J/cm^2, with only a minimal overlap of the applied pulses (a maximum of 10% of the spot size surface area). Most patients were treated initially with 6.5–7 J/cm^2 (11 of 19 treatments, with the higher energies used for the thicker lesions) and, if well tolerated, follow-up treatments were at 8 J/cm^2. Three patients were treated once, five patients were treated twice, and two patients were treated three times (at 2- to 3-week intervals) over the same area. Repeat treatment sessions were delivered at the follow-up appointment, when there was a partial response to the previous treatment and the patient desired further laser therapy. If no improvement occurred with therapy, then no further treatment was administered. The size of the treated area for each patient was approximatively 5–10 cm^2. In order to increase laser light penetration into the dry hyperkeratotic plaques, a thin layer of mineral oil was applied immediately prior to laser irradiation.

A severity score was designated for the plaques studied. The following parameters were used: erythema, scaling, and infiltration, with a scale for each of 0 = none, 1 = minimal, 2 = moderate, and 3 = severe. A control area with an initially similar severity score was judged at each visit. No other therapy was allowed on these plaques during the study, except for nonmedicated emollients applied to both the treated and control sites. Also, the patients did not receive any oral antipsoriatic medication for at least 2 months prior to therapy. On other psoriasis plaques, topical steroids were allowed. The patients were investigated every second to third week for 4–9 weeks. The last follow-up visit was at 2–9 weeks after the last treatment (mean 4 weeks). Photographs were taken at each visit.

TABLE 1. Psoriasis Severity Scores Prior to and Post Laser Therapy

Patient	Before therapy	After 2–3 weeks	After 4–5 weeks	After 6–7 weeks	After 8–9 weeks
1	9	6[a] (6)		2[a] (9)	2 (9)
2	9	3[a] (9)	3[a] (9)	4 (4)	
3	8		3[a] (5)		3 (3)
4	9	5[a] (8)	4 (6)	2 (6)	
5	8	5 (5)	2[a] (9)		0 (6)
6	9	5 (9)	5[a] (9)	3 (8)	
7	8	4[a] (9)	4 (8)		
8	5		3 (4)	3 (4)	2 (4)
9	6	4 (6)		3 (3)	
10	6		5 (6)		

Severity scores for erythema, scaling, and infiltration. Control area in parentheses.
[a]New treatment.

Histopathological examination

A 3-mm punch biopsy was taken from three additional patients before treatment, immediately after treatment, and after 1 week. The tissue was studied with hematoxylin-eosin staining.

RESULTS

In 6 of the 10 patients, there was a noticeable beneficial therapeutic effect, with a reduction in erythema, scaling, and infiltration. The psoriasis severity scale for the treated plaques was 2.2 ± 1.3 (mean ± SD) compared with the control areas that had grade 7.2 ± 1.7. When judged at their final evaluation, one of the patients had been treated three times, four had been treated twice, and one had been treated once. There was a tendency for several treatments to have a better effect than one treatment. The other patients did not exhibit any advantage over the control with laser therapy in three cases and only a minimal advantage in one case (a score of 5 in the treated area vs. 6 in the control). The treatment results are summarized in Table 1.

Histopathology studies showed the classical picture of psoriasis before treatment (Fig. 1). Immediately after treatment there was no significant epidermal change compared with before treatment. The main difference was vascular changes seen in the papillary capillaries, which showed further dilatation. Some capillaries were densely filled with erythrocytes, and minor extravasation of erythrocytes was present (Fig. 2). One week after therapy, the former epidermis was replaced by tissue repair, without any re-

maining characteristic signs of psoriasis in the epidermis or dermis. The epidermis was thin and showed regeneration. In the papillary dermis, there was proliferation of small vessels and some extravasation of red cells. Fibrinoid deposits could be seen at the dermo-epidermal junction (Fig. 3).

Almost all patients (8 of 10 patients) had black crusts after the treatment that were still seen at the follow-up after 2 weeks (Fig. 4b). The histological correlate is seen in Figure 3. Nine patients showed hyperpigmentation. One patient also had signs of hypopigmentation and atrophic scarring on his treated lower leg.

DISCUSSION

It is well established that the flashlamp-pumped pulsed dye laser can be successfully used for the treatment of benign vascular skin lesions such as port-wine stain, telangiectasia, spider nevi, hemangioma, and pyogenic granuloma [2]. In psoriasis the vessels are enlarged and dilated. It has been reported that the capillary loops of psoriatic lesions become dilated and tortuous before epidermal hyperplasia is detected morphologically [4]. An increase in blood flow at the active edge of a psoriasis plaque was reported by Hull et al., and this change often preceded the increase in T-cell infiltrates in the skin [5]. Specialized endothelia in psoriatic dermis are capable of mediating specific lymphocyte–endothelial interactions and may possibly regulate the traffic of lymphocyte subsets into psoriasis lesions [6]. Studies by Braverman suggest that the microvasculature plays a modulating role in psoriasis [7].

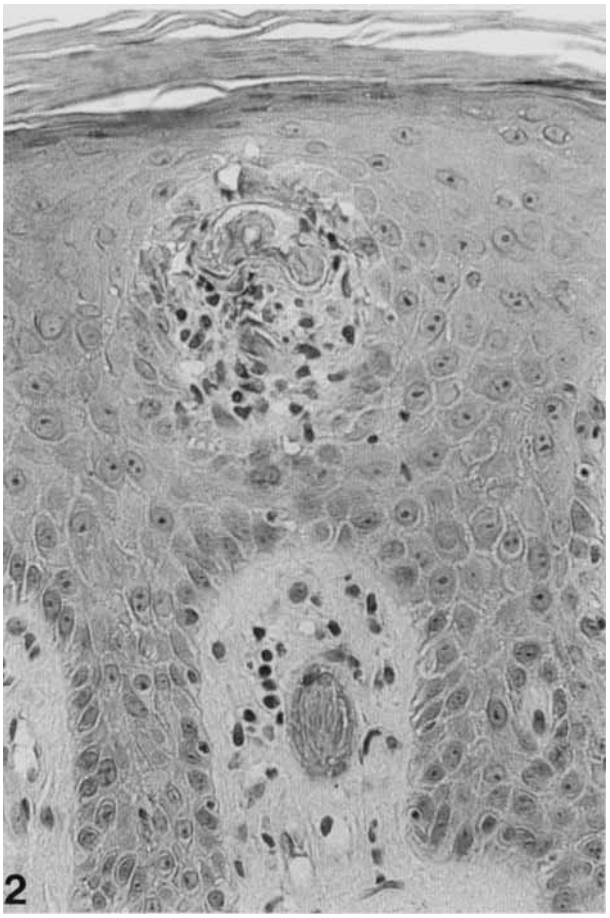
Considering these data supporting the importance of dermal vessels in the pathogenesis of psoriasis, it is possible that the flashlamp-pumped dye laser could have a beneficial effect in this disease. This is due to the precise selective vascular damage that the pulsed dye laser is able to effect [8]. Hacker and Rasmussen [3] have reported a clinically positive effect in 11 of 19 psoriasis patients after treatment with the pulsed dye laser.

In our study, an improvement was seen in about half of the patients. There was a tendency for several treatments to have a better effect than only one. However, almost all of the patients had black crusts after treatment, and one also showed atrophic scarring with healing. This was somewhat surprising because the energy densities used were similar to those used in the treatment of adult port-wine stain patients. When used for the treatment of port-wine stains, it is unusual to have any apparant significant loss of epidermis with those energy densities. Hacker and Rasmussen [3] reported their best results to be with energy densities of 9 J/cm^2, and they did not mention any side effects with these energy levels. In our case it seemed apparent that there was considerable clinical epidermal damage following laser therapy in most of the patients. However, most of our treatments were done on the legs, and perhaps there is an anatomical variation to the laser response.

Another possible reason for the increased sensitivity of the psoriatic lesions to the laser is that in psoriatic skin the dermal papillae are elongated, with a thinning of the suprapapillary portions of the stratum malpighii. The dilated capillaries in the papillae are close to the surrounding rete ridges, and there is an increased potential for lateral diffusion of thermal energy to the epidermis from the vessels after laser impact, with subsequent epidermal damage. Also, within a hyperplastic epithelium there is the potential for greater internal reflection of laser light with subsequent damage. In addition, the use of mineral oil on the surface may have allowed sufficient laser light access to the epidermis, which would accentuate any tendency for epidermal damage.

Other destructive treatment modalities have been described, with some effect in psoriasis, including dermabrasion, freezing, and carbon dioxide laser therapy [9]. Perhaps direct epidermal and/or possible dermal damage, other than vessel-specific change, may explain the beneficial effect seen with the pulsed dye laser. Biopsies taken immediately after laser therapy, however, revealed no signs of epidermal damage. It was not until secondary changes occurred that epidermal damage was evident. Still, in a complex disease such as psoriasis, the mechanism of action may be multifactorial, with direct damage to the vessels, and epidermal and/or dermal components producing a beneficial effect.

With regard to the use of the laser for this disease process, although this study represents a small number of patients, the histopathology reveals a therapeutic benefit as soon as 1 week after the procedure. Perhaps an accelerated time schedule between procedures may produce better results. However, the adverse effects of pigmentary change and scarring indicate the need for more investigation into its use as an acceptable therapeutic modality for psoriasis.



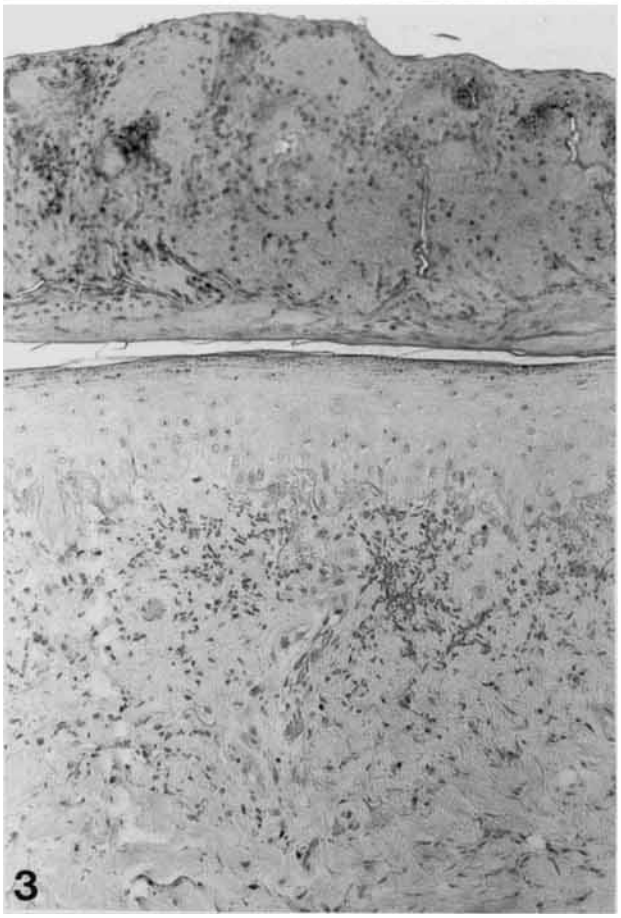


Fig. 1. Before pulsed dye laser therapy; the epidermis shows thinning of the suprapapillary stratum malphighii. In the dermis, there are widened and elongated dermal papillae, as well as dilated and tortous capillaries surrounded by a mild inflammatory infiltrate (Htx-E, ×250).

Fig. 2. Immediately after pulsed dye laser therapy; there is no significant epidermal change; however, there is further dilatation of the capillary vessels, which are filled with erythrocytes and are surrounded by some extravascular red cells (Htx-E, ×250).

Fig. 3. One week after pulsed dye laser therapy; the necrotic former epidermis is seen in the superficial crusting. There is epidermal thinning and regeneration. In the superficial dermis, there are fibrin deposits, proliferation of small vessels, and extravasation of erythrocytes (Htx-E, ×100).

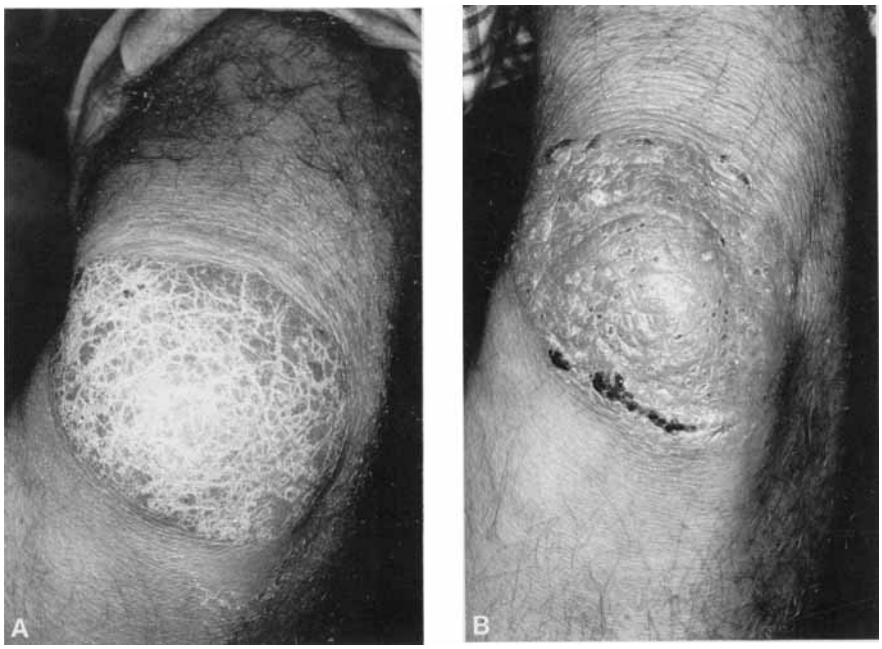


Fig. 4. **A:** A 59-year-old male with a psoriatic plaque over the elbow area. **B:** Two weeks after the first treatment with a flashlamp-pumped pulsed dye laser at 6.5 J/cm^2. There is still crust present over some areas.

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